Carrying Capacity & Ecological Footprints

3.7.1 Explain the difficulties in applying the concept of carrying capacity to local human populations
3.8.1 Explain the concept of an ecological footprint as a model for assessing the demands that human populations make on their environment

CARRYING CAPACITY

individuals or species that an environment can support*

Actual amount based on data (Humans don't know our C.C. because we keep changing it with technology)

C.C. is where a pop. can sustainably be maintained.

Carrying Capacity can't be changed (humans are the exception)

↓ population to ↓ resource use
technology to intensify land use

inverse of carrying capacity!

$\frac{1}{CC} = EF$

Ecological Footprint

Area of land & water required to support* an individual or population

*support - providing all resources & absorbing all wastes

Theoretical # (ex. your life style takes 6 Earths to maintain—there will never be 6 Earths to check this)

E.F. is not necessarily sustainable. & is often not.

*** E.F. can be changed:**

↑
- more use of fossil fuels
- more use of technology & thus more Energy
- high levels of imports (↑ transportation)
- ↑ per capita production of carbon waste.
- large capita consumption of food
- ↑ meat-rich diet

↓
- use less resources
- recycling resources
- reusing resources
- improving efficiency of resource use
- ↓ amount of pollution produced
- Export wastes to other countries
- ↑ technology to ↑ C.C.
- import resources from other countries

3.7.2 Explain how absolute reductions in energy and material use, reuse and recycling can affect human carrying capacity.

↓ in Energy Use
↓ in Material Use
↑ in Reuse
↑ in Recycling

↑ Human Carrying Capacity

Improvements in Agriculture

↑ Carrying Capacity

* But if fossil fuel dependent (oil, gas, pesticides) than not sustainable.
* ↑ carrying Capacity sustainably if → improve productivity of land or use sustainable energy.

Energy Conservation / Choice

↑ Energy Efficiency or more Sustainable Energy Choice

↑ Carry Capacity because less resources need to be used @ the power station.

Reduce, Reuse, & Recycle

↓ lower demand for material goods / raw materials so ↑ Carrying Capacity

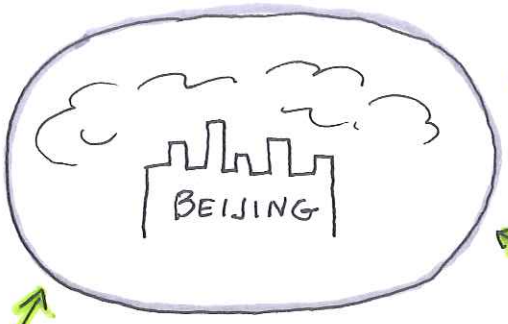
BUT may result in other pollutants / wastes.

BUT

Import of materials / resources / Energy

↑ Technology may cause ↓ Carrying Capacity if more inputs / outputs result.

3.8.1 Explain the concept of an ecological footprint as a model for assessing the demands that human populations make on their environment.



Food produced in other places

Power made from coal brought in from elsewhere

raw materials shipped in for industry

⇒ In order for the population of Beijing to survive "stuff" must be brought in & wastes must be dealt with

↑ Pollution in water & air gets swept away

* London is 170,000 hectares but EF of 21 million hectares

Food Production

MEAT-Based diet = ↑ Fossil Fuels (MEDC's)

VEG-Based diet = ↓ Fossil Fuels (LEDC's)

We will only look @ Food Production & Waste Absorption

This way of calculating EF ignores – aquatic & atmospheric resources, assimilation of wastes other than CO_2, replace loss of productive land with urbanization

Waste absorption

depends on capacity to absorb CO_2 → Forests & lots of Plants → absorb CO_2
deserts little productivity → Can't absorb CO_2

3.8.2 Calculate from appropriate data the ecological footprint of a given population, stating the approximations and assumptions involved.

Ecological Footprint = per capita land requirement for food production + per capita land requirement for absorbing waste CO_2 from fossil fuels

Simple Ecological Footprint Calc "IB's version

Per capita land Req. for food (ha) = **Per capita food Consumption (Kg/yr) / Mean food production per hectare of local arable land (Kg/ha/yr)**

Per capita land Req. for CO_2 Absorb. (ha) = **per capita CO_2 emissions (Kg C/yr) / Net carbon fixation per hectare (KgC/ha/yr)**

FOR Example:

	Food Consumption per capita (Kg/yr)	Mean Food production Per hectare (Kg/ha/yr)	CO_2 emission Per capita (Kg/C/yr)	Carbon Fixation per hectare (Kg C/ha/yr)
Brazil	210	2919	1900	10,000
CANada	710	3031	16,900	4000

Ecological Footprint Calcs:

Brazil → $\frac{210\ Kg/yr}{2919\ kg/ha/yr} + \frac{1900\ KgC/yr}{10{,}000\ KgC/ha/yr} = 0.26\ ha$ per capita

Canada → $\frac{710\ Kg/yr}{3031\ Kg/ha/yr} + \frac{16900\ KgC/yr}{4000\ KgC/ha/yr} = 4.45\ ha$ per capita

* BRAZIL is a LEDC → Less Meat / High Carbon Fixation due to Rainforest.

* CANada is an MEDC → More Meat Consumption More fossil fuel use.